

European educational diversity in technology entrepreneurship : a dialogue about a culture or a knowledge management class?

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European educational diversity in technology entrepreneurship: A
dialogue about a culture or a knowledge management class?

J.M. Ulijn, A. Fayolle & A. Groen

Eindhoven Centre for Innovation Studies, The Netherlands

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Technische Universiteit Eindhoven, The Netherlands

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European educational diversity in technology entrepreneurship: A dialogue about a culture or a knowledge management class?

by Jan Ulijn (Eindhoven University of Technology, NL), Alain Fayolle (INPG Valence, France), and Aard Groen (Twente University, NL), contribution to the AMLE special issue about *Entrepreneurship Education*

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1. Introduction

The concept of diversity is a typical example of a topic subject to dialogue about where technology entrepreneurship research should go and what accordingly should be formulated as educational objectives at schools of engineering within a special MBA or other framework. On the one hand, American approaches, such as by Shane and Venkataraman (2000) and Shane (2002) diversity seem to have merged already into a unifying concept valid for global application, on the other hand this seems to be questioned by considering diversity as an asset, as recent EU-reports (2002 and 2003) suggest for Europe and work by Dana (1999, 2002) indicates for other parts of the world. What European and Asian concepts of entrepreneurship (see Kao et al., 2002) seem to have in common is the role of the government and, hence (?), in a network-driven collective wealth creation. Can a government be entrepreneurial? In a longitudinal study of Dutch Internet start ups (EIM, 2003), those entrepreneurs had worked alone, but in an increasing cooperation with each other. Is this because of the investment of the Dutch government now 5 years ago, which was not high anyway compared to other European countries? In the case of technology entrepreneurship

(education), in particular European diversity within a supranational institution, such as the EU might not only a matter of culture of several levels (national, professional, corporate), but also of content. Is the technology entrepreneurship class rather a culture or a knowledge management class?

The link between entrepreneurship and engineering seems to be a very special one: It cannot take shape in the splendid isolation of getting an idea and look for a market for it. Knowledge management between different partners, such as a R&D facility of an MNC or innovation ideas emerging from co-design of supplier and users of services, processes and products might lead to High Tech Start Ups (HTSUs) (a.o. Groen & Van der Sijde 2002), for instance. The latter is typically the domain of engineering graduates. How to prepare them for diversity both different cultures and contents of customers and other stakeholders?

Slogan/question 1: Is European diversity in entrepreneurship education a matter of culture or content?

So far a strong American influence on the development of a scientific concept of entrepreneurship has been obvious through International and A-journals, which are mostly American. Europeans read American books and journal articles on the matter, but what about the opposite? There are recently more European contributions to the field, by upcoming books, such as Brown and Ulijn, 2003 and Fayolle et al., in prep) which derive from the common research activities of the *CLUSTER taskforce on Entrepreneurship and Innovation* with other partners. The last one is an initiative taken by the EPF Lausanne Branco Weiss Entrepreneurship chair and started in Dec. 2000. CLUSTER stands for: Consortium Linking Universities of Science and Technology for Education and Research, a network of 12 leading universities of technology in Europe. Apart from joint research concerns, consultation on ideal incubators for HTSUs, etc. and entrepreneurship education is of prime interest to its participants. Special European conferences lead to book series on HTSU. For example the series edited by Ray Oakey and Wim Daring c.s. on more than ten years of High Tech Small firm conferences in Manchester and Twente. Also special issues of existing journals, such as the *Journal of Enterprising Culture (JEC)* by Ulijn et al. (2001) and Fayolle et al. (2004) and the foundation of new journals, such as the *Journal of European Entrepreneurship Research (JEER)*, by Francis & Taylor Publishing) and the *International Journal of Entrepreneurship and Small Business (IJESB)*, by Inderscience) are based on material presented at European conferences.

This contribution presents some key questions, related to a framework of training rigor, which predicts for simulations the highest degree of participant involvement and rigor and hence the most effective (?) (see Black et al., 1999). One of those means (textbooks and handbooks) needs no longer to be exclusive American, since the entrepreneurship educational needs outside the US seems to be more diverse. To partner up between the US and the Europe, the *REEE (Round Table of Entrepreneurship Engineering Education)* constitutes another

forum of cooperation. How to develop international technology entrepreneurship through both research and education? This piece will address the issue of European diversity in culture and content in an integrated way on the basis of a dialogue between 3 schools of engineering entrepreneurship centers (two Dutch and one French) within the framework of recent contributions to AMLE by Mintzberg & Gosling and Ferris (2002) (Section 2) with a special role for the EU as a supranational institutional organization to develop entrepreneurship (culture) (Section 3), where the link between engineering and education is missing (Section 4). Then the dialogue itself will be presented with its results (Section 5) followed by conclusions comparing the impact of the US and the special role for Europe from an intercultural perspective (Section 6). Our results lead also to some implications for a special role of technology entrepreneurship education as a form of knowledge management between stakeholders giving substance to the educational partner model proposals by Mintzberg & Gosling and Ferris (Section 7). To what extent is European educational diversity in the technology entrepreneurship classroom a matter of intercultural and/or knowledge management?

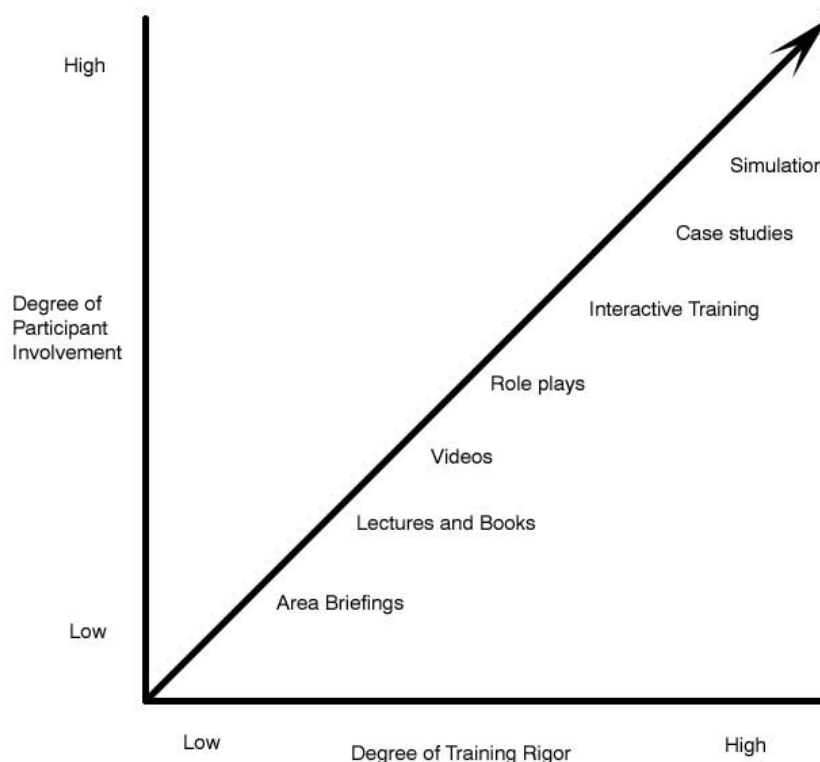
2. Educational content and means: partnering between students, teachers, entrepreneurs and researchers?

One appealing source of educational diversity in technology entrepreneurship seems to be the variety of the content matter and the means to achieve the learning objectives. How to develop an entrepreneurial spirit and mindset, make sure that the required R&D capacity is accessible, the venture capital is available, customers can be tracked and the start up is eventually profitable? Is this a matter of acquiring knowledge or developing skills or a mix and which ones? Basically two options emerge: *DO, SHOW and TELL* which is rather Anglo-Germanic/Nordic/North-American/North West European style and *TELL, DO and SHOW* which seems to adapt better to Latin and Asian students.

Let us take the example of how to become a successful entrepreneur by presenting and negotiating effectively a business plan from the professional experience of one of us (Jan Ulijn). In a role play students did not get too many examples to copy from beforehand, displayed a certain negotiation behavior according to the rules given in their briefing and during the debriefing implications were drawn by the teacher post hoc: what did we learn from this role play for your general insight in the theoretical process and its application to business practice (see Ulijn et al. 2003 for an evaluation). This role play was done with students from about 11 countries and experts from 3 additional ones, but no attempt was made yet to see if *DO, SHOW and TELL* would work for instance better with Anglo-Germanic and Nordic students and *TELL, DO and SHOW* still better with Latin and Asian students, as earlier non published data by Ulijn (1993) from the University of New Mexico Business School in Albuquerque (US) suggest. A negotiation class was taught there for both broad cultural categories in the above two ways using a scrambled design to control for an order effect and evidenced the first option as being a favorite for American students and the second privileged by French and Mexican students.

This corresponds more or less with the teaching/training dilemma. The French educational system, for instance, does not like the term training which is rather linked to skills and practice and might ignore the sacrosanct theory: *Copiez les maîtres* (imitate the masters), to become the ideal entrepreneur one has to look at the perfect examples in order to be successful (see the contrastive French-US educational discussion by Lempereur, 2004 of this teaching/training dilemma in negotiation in general). The *DO, SHOW and TELL* way would be very much: just do it, learning from your mistakes (trial and error). You can become an entrepreneur just by trying to become one.

As Fig. 1 shows there are several means to teach or to train future technology entrepreneurs. Black et al (1999) suggest on the basis of their experience how to globalize people through international assignments a repertoire very much in line with the teaching/training dilemma. If one teaches through area briefings, lectures, books, and videos, the degree of participant involvement and training rigor is low, but how does one know what the learner is doing with this input to develop awareness, insight, etc.? Nothing better than a good theory (cfr Kurt Lewin's famous statement) to apply later? On the other hand role plays, interactive training, case studies, and (computer-driven) simulations (for instance in starting a business with all its complications) increase considerably both student involvement and training rigor in a testable way, but will the participants become successful entrepreneurs eventually? In this dialogue some data will be presented about the diversity of educational means uses to develop technology entrepreneurship (see Section 5).



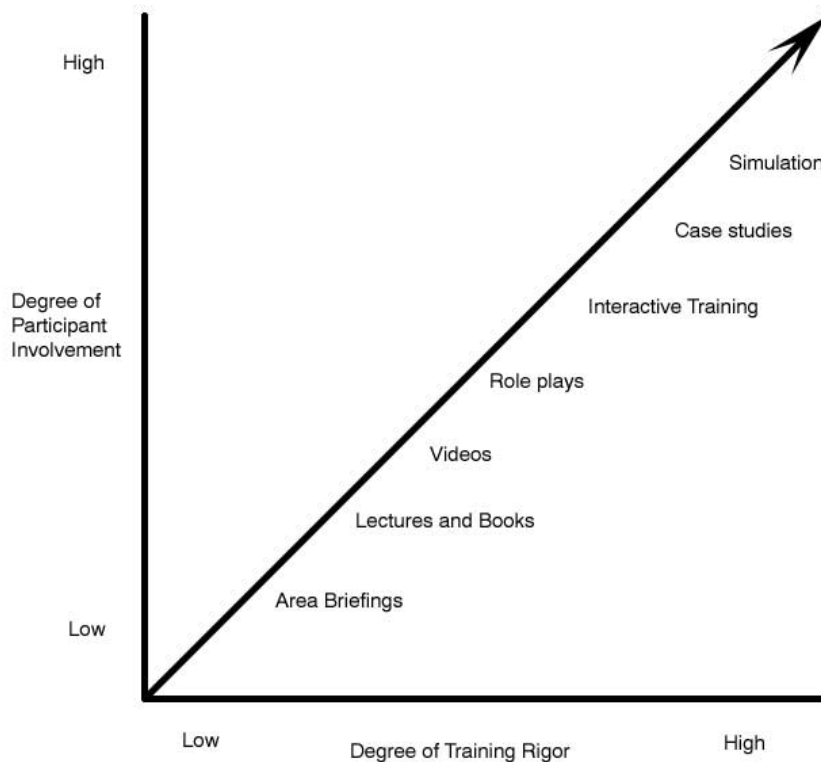


FIGURE 1
Which entrepreneurship educational means are the most effective?
 Adapted from Black et al.1999. *Globalizing People through International Assignments*. Reading, Mass.: Addison-Wesley

Black et al. 's training rigor theory seem to gain support from the ideas by Mintzberg & Gosling (2002) on management education in general: Think first, interact and do later. The management education classroom can be a place where managers reflect thoughtfully on their experience beyond the classic professor-student interaction. Globally this would mean that a new European mindset for entrepreneurship should go accordingly from reflection, collaboration and analysis to action involving a diversity of stakeholders. This is no longer jump in the deep by an American style of learning by doing, learn from your mistakes or a French/Latin teaching ex cathedra in a one way what one should do to become an excellent entrepreneur, but a combination of teaching and training. This educational paradigm would not only be an interaction between professors and students, but in the case of entrepreneurship development may include other stakeholders or partners, such as financial, legal, technological and marketing experts apart from entrepreneurs telling not only about their successes, but also about their failures without any reluctance.

The partnership model proposed by Fennis (2002) for collegiate business education might be very useful here. It exemplifies an interaction/collaboration mindset (needed between start ups as Ulijn and Fayolle, 2003, evidence) between students, professors, entrepreneurs, potential customers of the start up and all kinds of experts: how to foster entrepreneurship appetite in yourself. Of course this model (see Tab. 1, Ferris) applied to HTSUs has restrictions on external validity. Is simulation, for instance, the real thing, although it might prepare for unhappy surprises in one's entrepreneurial ventures?

Last but not least, researchers could participate in this partnership model. Not only R&D researchers displaying the creativity in possible innovative products, processes and services, but also researchers of technology entrepreneurship. It is obvious that the educational content at stake here involves a diversity in learning styles, participants, educational means and their interactions. Developing an entrepreneurial spirit or mindset is probably not the sole objective to reach, but also how to interact with the environment which might be beneficial or hostile towards the starting entrepreneur. This context implies not only family, friends and peers, but also the role of local, regional, national and even supranational governments. Talking about Europe, the EU plays and increasing role in entrepreneurship development. Is this effective and if not why not (yet)? What is the role of universities?

3. The role of the European Union as an institutional organisation to develop technology entrepreneurship (also from a cultural perspective).

Europe has to play a major role in technology entrepreneurship, a lot of inventions were European and not only the classic ones, such as the ones by Fleming, Watt, Bell, but also more recently, for instance by Philips (audio-cassettes, compact disk). The European market is important and will soon grow from 380 to 450 million customers, as opposed to 300m in NAFTA, or 200m in the US.

Therefore we take a critical stand and develop a dialogue here about what we should teach and train and how in entrepreneurship development for engineers and others in the following lines.

Slogan/question 2: Dr. Ellen Plooi, MEP of Committee of Industry, Trade, Transport and Energy): Europe invests a lot of euros in R&D, but when does R&D return euros to Europe?

Members of the European Parliament (MEPs) have repeatedly uttered statements, such Dr. Plooi above (see also Ulijn and Gould, 2002). Although the Committee of Industry, Trade, Transport and Energy invests a lot in European R&D, we are here not yet on our way to 15 million new jobs to be created by 2010, as the EU Enterprise Directorate-General pinpoints in its *Green Paper 'Entrepreneurship in Europe'* (2003). This cannot be trusted only to MNCs, on the contrary 75% of all new employment in both the US and Europe seem to take place in SMEs and start ups. The 10 questions for the European agenda on

entrepreneurship range from objectives to be set, availability of finance to be improved, spotting of hindering factors, network development, to all kinds of education and e-learning, also for women and ethnic minorities, special attention for the new members of the EU, spin offs, how to reduce the negative effects of bankruptcy, the role of the universities, the media and national, regional and local government. An expert group of the European Commission (2002) of the 15 EU member states and Norway draws some interesting conclusions on the basis of their 'Best Procedure' Project on *Education and Training for Entrepreneurship* listing 9 best practice criteria and both 'qualitative' and 'quantitative' indicators on entrepreneurship education on the primary, secondary and tertiary levels, including teacher training and cooperation between educational institutions and businesses. One major role for the universities could be to measure their effect of coaching and information supply in actual start ups. Some (international and European) centralization of teaching materials might be helpful, such as through the French OPPE (Observatoire des Pratiques Pédagogiques en Entrepreneuriat) and the CLUSTER/REEE efforts (www.entrepreneuriat.net).

It is striking, however, that both recent EU policy papers still lack technology and innovation as a main source of creation of new enterprises and the need to educate engineers to start businesses. A focus on Technology entrepreneurship seems to be strongly required: engineers are not entrepreneurial enough, how to train them for a culture/mindset change? To what extent is the natural cultural diversity here an asset or a handicap? There are intra-European differences in entrepreneurship styles and effects as well North and South (for instance The Netherlands (NL) vs France in this paper and vs Germany in others (see Ulijn & Fayolle, 2003) or between East (Bulgaria: Kolarov) and West (Portugal: Silva) as examples of diversity in Fayolle et al. (2004). Not only national borders, but also corporate and professional ones seem to create sources of cultural diversity, as Ulijn & Weggeman (2001) have outlined in their design of an innovation culture.

It might be that the main cultural obstacle is that of professional cultural differences between engineers, economists, marketers, etc. Moreover, technological innovation and entrepreneurship do not get linked up together automatically, as several chapters to Brown and Ulijn (2003) indicate. Not all people are innovative or entrepreneurial, it seems that apart from a specific personality, a special mindset, climate or culture is needed for this. Within the framework of managing high technology and innovation, Levy (1998) outlines how to create a culture of innovation and entrepreneurship through identifying and encouraging champions and entrepreneurs and using different management methods, such as high management involvement, listen-to-the customer, and entrepreneurial greenhouses, but what is innovation and entrepreneurial culture? A comprehensive recent handbook on entrepreneurship, such as the one by Shane (2002) does not deal with psychology or culture, which is amazing given some breakthrough studies by Shane earlier in his career about innovation culture (1992, 1995, 1997 and with Venkataraman and MacMillan, 1995 see the Ulijn and Brown chapter in Brown

and Ulijn for the exact sources). The same holds true for his outline of entrepreneurship as a field of research with Venkataraman (2000). European and international entrepreneurship cannot do without culture, as McDougall and Oviatt (2000) clearly point out, since international entrepreneurship is a research path that intersects with that of international business. Amazingly their concept of international entrepreneurship does not include networking, collaboration, alliancing, so much needed in technology and among engineers as recent European studies evidence: Halman et al. (2003) for HTSUs in the Eindhoven area in The Netherlands, Guerra et al. (2004) in their Italian, Dutch, British and German comparison of cooperating in technology start ups, and Ulijn & Fayolle (2003) who position French, German, and Dutch entrepreneurial and innovative engineers with respect to co-operation between European start-ups.

Why does engineering miss out with entrepreneurship? Apart from professional culture, knowledge might create a gap as well, how to unlock the mystery of tacit knowledge and release the power of innovation through knowledge creation, as the title of a book by Krogh et al. (2000) says. The path of engineering to entrepreneurship seems to lead via innovation and knowledge management (see also Section 10). Whereas the impact of the EU contributes to cultural diversity in entrepreneurship education, the link with engineering seems to lead to content diversity. To what extent?

4. What is difficult between entrepreneurship and engineering and what can education do about it?

Few research have been done on engineers becoming and acting as entrepreneurs for their own. From the results of some of them (Fayolle & Livian, 1995; Brinkman, Van der Heijden & Daring, 2001), it seems obvious that all the engineers who become entrepreneurs (entrepreneur engineer) do not create HTSUs. Among factors which appear to play a role, the career path is probably of the first importance. For example, Fayolle (1995) developed two main models which could characterize the engineer and also the entrepreneur engineer. The first model is this one of the engineer who leaves his/her technical and scientific context before setting up a new business. This kind of entrepreneurs is identified under the name of "manager" entrepreneur engineer. In the second model, the engineer does not leave his/her technical and scientific context before creating a new company. He/she remains strongly involved in the technical and scientific dimension of his/her job. This type of entrepreneur is known as a "technician" entrepreneur engineer. In the Fayolle's sample, a very high number of HTSUs come from the second model. The first type of entrepreneur engineer is much more oriented to create low tech companies. To sum up the Fayolle's main results, the path which leads an engineer to setting up a new company is strongly influenced by his/her initial training, by the status of the engineering school from which he/she has graduated, by the professional career and experience he/she has acquired, by the technical skills and competencies he/she has developed and also by some personal factors. This path leads to very contrasting entrepreneurial profiles. In

their research on careers of entrepreneurial engineers, studying on entrepreneurs in knowledge intensive firms in the Netherlands, Brinkman, Van der Heijden & Daring (2001) point out four categories of career paths leading to four different profiles of entrepreneur engineers. Each of them is depending on a technical versus management professional competence. These results highlight the importance of education and training both at the initial and vocational levels.

As has been suggested before there seems to be a knowledge gap between the scientific fields of entrepreneurship and engineering. Here we will try to analyse what the nature of this gap is and what education can do about it. From the perspective of entrepreneurship the link with engineering is poor and with (technological) innovation not always obvious. In their promise of entrepreneurship as a field of research, Shane & Venkataraman (2000) and in Shane's (2002) *Foundations of Entrepreneurship* is apart from the lack of psychological and cultural/innovative aspects, no clear explicitation of the link with engineering and R&D as such. In a recent handbook of research on international entrepreneurship (by Dana, 2003) there is hardly any focus on technology entrepreneurship, whereas one might assume that technological innovation might be a rich source of HTSUs, etc. Is this because most of those writers are not engineers themselves or do not work in an engineering environment? Why this gap: does one have to be an expert on the specialized content matter to think about entrepreneurial implications?

On the other hand from an engineering perspective, entrepreneurship seems to be a bridge too far as well. In his careful analysis of 4 typical cases of academic entrepreneurship in nano-electronics, materials, applications and scientific devices in an incubator related setting with a variety of R&D orientation and success, Meyer (2003) concludes is that public support mechanisms seem to work only with entrepreneurial academics if they can promote their own research this way, they are less interested to start a fast growing company. A clear division between academia and business contributes to success, the more successful cases involved academics that knew how to connect to experienced industrialists that were able to help them. Finally a commercial start up advice should be given before the company was set up not after. It seems to be easier to educate entrepreneurial academics (scientists and engineers) than develop academic entrepreneurship in general.

Another sector of entrepreneurial activity is ICT and the Internet. Although the knowledge of this engineering field might be easier accessible for non-engineers than for instance, nano- or bio-technology, the dot.com debacle has shown that the question remains how to use this knowledge in profitable entrepreneurial activity, expressed in successful HTSUs. A study by Waesche (2003) comparing several European countries and US indicate that costs of Internet access related to number of Internet hours per 1000 inhabitants vary considerably across national borders. The more intensive the use, the least were the costs in the following decreasing order of hours and increasing costs: The US, Sweden, The Netherlands, France and Germany, at least in 1998. The eventual capital

investments for technology in general gives another order of decreasing totals from 1196 to 2000: US, France, Germany, The Netherlands and Sweden, although may be not corrected for number of inhabitants per country. Variety and diversity seem to be key in this form of technology entrepreneurship as well. Were entrepreneurs starting with ICT technology more successful here than the ICT experts themselves?

There seems to be a double gap between entrepreneurship and engineering. It may be closed by a special focus on technology entrepreneurship in education.

Slogan 3: TECHNOLOGY entrepreneurship is needed to bridge a double gap between entrepreneurship and engineering.

The above examples show that more cooperation is required between engineers and entrepreneurs in the two fields. Nano- bio- and environmental engineering seem to lag behind when it comes to start ups in many countries: a management, economics or even an industrial engineering or technology management training is not enough. Might it be easier to educate engineers to become entrepreneurs than to educate entrepreneurs to become engineering minded? Such technology entrepreneurship development in an engineering curriculum seem to need the following at least:

1. Integration of Engineering and Entrepreneurship, such as through double engineering diplomas in technology management and entrepreneurship (Ecole Centrale and ESC de Lille) or integration of a strong entrepreneurship component into an engineering curriculum (the NIKOS MINOR at Twente University, see below). This way the link with innovation, knowledge management, and R&D can be made explicit.
2. Technology entrepreneurship in an international/European cooperation context. To be innovative an entrepreneurial engineer needs a R&D resource which one cannot afford to do one self (see Ulijn and Fayolle, 2003 about co-operation and networking between European technology start-ups).
3. Development of an entrepreneurial spirit/mindset, intent, posture, culture, no fear for failure. In a sample of 500 UK exporters Balabanis & Katsikea (2003) could find that larger firms had a better entrepreneurial posture towards international exporting encouraged by an organic culture and less by structural measures, but export performance was hampered by environmental hostility. What can HTSUs learn from this?

It is promising to see that some research projects may support this aspect: at Imperial College (about the effect of entrepreneurship education on entrepreneurial attitudes, intentions and start up activities, see Souitaris, 2003), at INPG (on commitment within a longitudinal survey of entrepreneurial engineers as part of a similar attitude/intention framework, see Desgeorges, 2003), at Eindhoven University about risk taking, entrepreneurial and innovation culture, negotiation, see Halman and Ulijn et al.), at the Ecole Centrale de Lille (on entrepreneurial spirit). How can those research results be reflected in technology entrepreneurship education, what is the state of the art

at 3 European universities both from the perspective of culture and content diversity?

5. A dialogue between 3 European universities about educational diversity in technology entrepreneurship.

Within the above described CLUSTER network of 12 leading technical universities a questionnaire was developed by Dr. Tim Meldrum of the London Imperial College of Technology. It addressed some key questions, such as the training/education dilemma, the vocational vs the academic profile of this teaching, its embedding in the different engineering schools of a university. To what extent is the teaching content research and business practice based and last, but not least, should it have a local or an international/European character (in which CLUSTER plays a role)? What is the most effective organization framework, within one institute? Who is the best educator: the research-driven academic or the ex-entrepreneur/practitioner with both positive and negative start up experience? It had the following main structure: Teaching diversity, training vs education, research and teaching, and methods and assessment, in total 13 questions. Although this tool was not developed to answer our main question: should the European technology entrepreneurship class be a matter of intercultural management or knowledge management or both? The basic issue was European diversity in this class, so we were able to draw some conclusions on this topic and also about its effectiveness by asking questions about the teaching/training dilemma. In addition we present the results of the above discussed adapted framework of training rigor, which predicts for simulations the highest degree of participant involvement and rigor and hence the most effective (?) (see Black et al., 1999).

This dialoguing will focus on the answers to those questions by two Dutch (Eindhoven and Twente Universities) and one French engineering school (INPG), summarize its commonalities and outline its differences for mutual learning effect. Basically our own 3 institutions were interviewed through a written questionnaire with open questions. Our ambition is, of course, only to start a dialogue about the technology entrepreneurship class with its cultural and content diversity and probably not only in Europe. Below the answers of Eindhoven, Twente and Grenoble schools of engineering (in this order) will be summarized by focusing first at the commonalities and than at the differences which explain the educational diversity in the two countries (The Netherlands, and France) and the 3 institutions compared. The main headings of the questionnaire will be followed going across the 3 or 4 questions under each heading. Sometimes we moved the summary of one question over to a more logical place. We adapted the original wording of the respondents, where it is striking that Grenoble uses education as a generic term with teaching and training at the same level and others might use education more or else as synonym for teaching (see teaching/training dilemma below).

Educational diversity

The common things here are the use of American textbooks, but in Eindhoven and Grenoble much less so than in Twente. The educational content has mostly a local bias, but in Twente more international and in Grenoble more national, the director (one of us: Alain Fayolle) of *EPI (Entrepreneurship and Process of Innovation)* research center acts also at the European level as an educational specialist. CLUSTER may serve as a database of educational materials, Eindhoven has its own well developed web site for this, whereas in Twente and Grenoble this is under construction.

Training vs teaching

The above discussed teaching/training dilemma is well reflected in the 3 answers. All are talking about a mix of methods used pinpointing skills training as very important, but only Twente is very specific about it negotiation, project management, presentation. Implicitly one of us knows (Jan Ulijn) that both Eindhoven and Grenoble are doing this as well, since he is involved in it. Grenoble seems to agree with Lempereur's conclusion about the developments in French education that the notion of training tends to be more accepted as part of academia, but lectures (conferences in French), also by entrepreneurs, often appointed as associate professors remain to have a special status to get business practice in. Education of this level aims to develop entrepreneurial spirit and culture in Grenoble.

Research and education

The credibility of an entrepreneurship program derives not much from a vocational profile which is more trusted in NL to Polytechnics without a research or PhD thesis preparation task, whereas INPG as a Grande Ecole d'Ingénieurs in France with its competitive entrance exam (concours) is still educating (not training!) an academic elite. Twente and Grenoble have a more integrated educational and research program in entrepreneurship and innovation. In Twente this is combined in *NIKOS*, Nederlands Instituut voor Kennisintensief Ondernemerschap: Dutch Institute for Knowledge-intensive entrepreneurship) of which one of us (Aard Groen) is the director. In Grenoble this is organised in *EPI* headed by Alain Fayolle, whereas in Eindhoven the innovative entrepreneurship center is not doing any research at all on those matters. It is done at *ECIS (the Eindhoven Center of Innovation Studies)*, of which one of us (Jan Ulijn) is a fellow. The number of interested engineering (non MBA!) students is increasing in the 3 institutions compared, but with 20 % of all students participating Grenoble ranks the highest, whereas Twente, with 20 European credit points for its MINOR program, has the most intensive program, offered by NIKOS.

Methods and assessment

The above Fig. 1 from Section 2 about the entrepreneurship educational means which are the most effective, might serve here to frame our comparison. Tab. 1 gives the results and we use the questionnaire answers for additional

comments, finished by some concrete examples.

TABLE 1

Distribution of educational means at technology entrepreneurship centers of 1 Dutch and 1 French Schools of Engineering (in %, total 100%)

	INPG (F)	UT (NL)	TU/e (NL)
1. Area briefings	5	15	15
2. Lectures and books	40	25	20
3. Videos			
4. Role plays		5	10
5. Interactive training	15	15	20
6. Case studies	20	20	10
7. Simulation	15	15	20
8. Other	5	5	5

One of us (Jan Ulijn) asked the authors of this dialogue and Bart de Jong of Eutechpark in Eindhoven, to distribute 100% (our rough estimates for our own school) over the different educational means for entrepreneurship development (inspired on the Black et al. model). In Grenoble for EPI and CEI (Cellule Entreprise et Innovation), in Twente at NIKOS, in Eindhoven at Eutechpark, ECIS and the department of Organisation Science (Jean Monnet chair). The results serve only to explore mainly the teaching/ training dilemma. Apart from lectures and books the other categories overlap at least in the minds of the respondents. Area briefings and case studies developing awareness and insights as lectures and books might do, role plays come back under simulation, lectures might have a strong interactive character, if given for small audiences. The category "other" include guest lectures of entrepreneurs and intermediary actors (Chamber of Commerce, department of taxes, relay center), feedback sessions on business plan development by practitioners and academics, and material from business plan contests (for instance New Venture).

One of us (Jan Ulijn) adapted the figures slightly to harmonize the minds of the respondents and himself for a more reliable comparison. Because of the overlap across the means, the only figure for lectures and textbooks seem to indicate that Grenoble spends more time on lectures and books as the classic ways. In Twente and Eindhoven American textbooks to the extent used (25 and 20%) are always adapted to local cases. Area briefings can be very useful for concrete technology entrepreneurship developments by visits to HTSUs in and outside specialized incubators, etc. (see for a specialized textbook on this mater

MacVicar & Throne, ***). Given their training effect, it is striking that role plays are not very popular (absent in Grenoble, only 5% in Twente). With some exception may be in Eindhoven (10%) where negotiating a business plan, for instance, would be an example of a combination of a case study and a simulation as well (see Ulijn et al. submitted). In Twente playing roles is a part of training in sales skills, negotiation and leadership, but form only small part of the content of the courses.

The case study, however, is favored as a link between theory and practice (20, 20, 10). Real live cases from the region have been developed in Twente, which enables us to give the students the possibility of getting feed back on their analysis of the case by the entrepreneur who created the firm under study. Another integration pursued is offering the students theoretical frames from our own research projects as analytical tools for analyzing case studies. This connects research to teaching. A prominent example of a personal case study is the simulation of the business plan preparation, presentation, feedback and assessment through competitive European contests. It brings in not only academic entrepreneurship educators, but also (ex-) entrepreneurs as business practice experts (15, 15, 20). In Twente not only business plans are simulated, also real enterprises are set up by the students and part of their study activities. Simulations, in case of Grenoble students are working in teams of 4 persons on an entrepreneurial projects. In Eindhoven, students work in smaller teams of 2 to 3 on analyzing and/or designing of business plans (including extended implementation plans). In Twente the teams for simulations are often comprised out of 4-6 students, but for the real life cases teams consists mostly out of 1 or 2 persons.

In Eindhoven the whole final business plan presentation/simulation with experts, etc. is done at a German resort park (CALCAR, a never finish nuclear power station owned by a successful Dutch entrepreneur), without any contacts with German future entrepreneurs. In general Eindhoven seems to be much better in international cooperation in research than in education. In Twente business plans are designed using scientific methodological demands, and they are presented to a forum of entrepreneurs, venture capitalists, consultants, and professors. In their comments practioners in the forum state their surprise of the rigor of the plans, which they do see as over stated for practice, but still as interesting results. Alternatively Twente also uses academic papers on topics related to the entrepreneurial process (and to our research). Furthermore, students aerasked to make smaller practical assignments on specific topics (e.g. high tech marketing, Intellectual property rights, financing the enterprise).

None of the 3 entrepreneurship centers seem to claim the exclusive right in entrepreneurship education, although research excellence needs focus, concentration and specialization, which is done differently organization wise in the 3 locations. They all share the need of academic credibility though internationally recognized research, so the teaching/training dilemma subsists. If one becomes too practical, one is forced to acquire its sponsors outside academia. With respect to the educational means used in entrepreneurship

education, the teaching/training dilemma is proved once more. Although business practice training is very much needed, the involved professors get more academic and financial credit for theorizing and doing research in the field. Both are indispensable, of course, but many of us feel themselves in a constant splits situation. Is this more so in France than in NL and more in Europe than in the US?

In sum, there are more commonalities in the entrepreneurship education at the 3 institutions compared than differences. The educational diversity is more present in the different methods of teaching and training used than across institution or national borders. To what extent now is a culture or knowledge management class emerging? Although knowledge (the label of NIKOS in Twente!) and innovation (innovative entrepreneurship center and ECIS in Eindhoven, EPI, CEI in Grenoble) is mentioned several times, it does not seem to be very obvious yet in terms of educational objectives within the strong limitations of those 3 answers. For this reason we will make no attempt to generalize this situation to other major European players in the field, such as EPF Lausanne, the London Imperial College of Technology, the Stockholm Royal Institute of Technology and Polytechnics in Torino and Barcelona, since their answers were not available at the time of this writing. However, attendance and minutes of about 10 CLUSTER and REEE-E meetings give us ways to believe that the notions of intercultural management, international cooperation and knowledge sharing in particular in the case of the specific engineering culture across national cultural borders in Europe are not yet used in a very explicit way.

6. Conclusions from an intercultural perspective within Europe and compared with the US.

Entrepreneurship has been so far very much an American concept. Most of the scientific literature and the textbooks used originate from this countries, even if non-Americans are researching and writing there (see the sources we referred to so far in this dialogue). Entrepreneurship education seems to be rooted more in an MBA-style of program than in engineering programs and not only in the US. What can Europe and the US learn from each other and what could they learn both with respect to the technology entrepreneurship classroom? We try to go here beyond the findings of the 3 interviews in European universities summarized above.

Slogan 4: Get away from MBA as a sole supplier of entrepreneurship development!

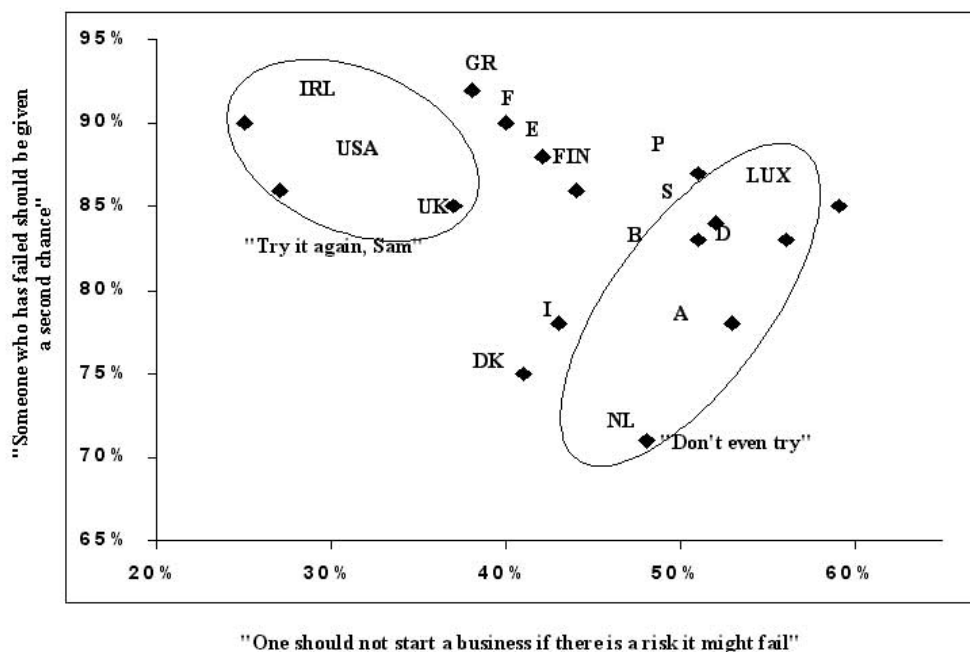
In Europe MBAs have been so far a mixed success. In France and in Germany, for instance, the business educational programs proposed are considered as not specialized enough, even if they address business executives who have already an engineering degree. This would mean that in the case of technology entrepreneurship more integration on the level of technological innovation, technology and knowledge management would be required to lure engineers into more HTSU ventures than it is the case now. Content diversity in both the

US and Europe and other parts of the world is a good thing in this sense! The following suggestions of the Trinity College Center of Entrepreneurship in Dublin (Ireland) may help profile technology entrepreneurship education:

1. Undergraduate exposure to entrepreneurship via courses and some internship or practical work either starting up companies, or planning for one,
2. Masters degrees in entrepreneurship: for three reasons:
 - To have a professional academic discipline incorporating what is known about the subject, (ie straight University discipline)
 - To educate managers in companies about Innovation and entrepreneurship which may be practiced within organizations from universities, through state services and in multinationals.
 - To equip people to start up new business, and this latter is likely to require just in time training and a few concerted concentrated modules rather than a whole year at once. If this is done with a strong start-up project as the "experimental work", this might qualify as a degree.

HTSUs requires a lot of risk taking which is another source of variation between both sides of the Atlantic with Ireland an the UK in the middle (see Fig. 2).

FIGURE 2



American and European willingness to take the risk of starting a business
Source: European Commission, Eurobarometer 2000 and Boston Consulting Group

In (continental?) Europe people are often looked after from the cradle to the grave or from womb to tomb. To the statement: *One should not start a business if there is a risk to fail*, survey respondents from Ireland, the UK and the US would react with "Try it again, Sam", Dutch and Germans would react with "Don't even try" with other European countries right in the middle. However: Who does not venture, shall not win! In the case of engineering, technological innovation needs a lot of R&D efforts, which go beyond the financial capacity of a good willing individual engineer or scientist. As we have seen in the cases presented by Meyer, which might explain partly why engineers are taking less risks to start their own business. Moreover, a recent survey by Accenture (www.accenture.com) among 880 senior executives in 22 countries tells us that aversion to risk and failure stop people to act entrepreneurially in their organizations for 73% of the respondents. Therefore, to liberate the entrepreneurial spirit, not only an individual personality or mindset should be developed, but also a collective one embedded in the culture of the groups to which the potential entrepreneur belongs: both national and professional cultures (engineers vs other stakeholders), the latter being largely ignored so far as a point of consideration. Part of this is how to deal with risks and failures and reduce them by efficient cooperation and networks with suppliers, clients, and R&D resources. How to draw the ideal entrepreneurial and innovative profile to be used should be one of the educational objectives to aim at. In research on Global start ups in for example Nano-technology or ICT, we see that engineers can very well become very international and entrepreneurial. These cases of management of global networks, performance of good R&D and setting up a business at the same time are interesting sources of experience (Wakkee & Groen, 2001). Entrepreneurship needs also mobility, which is much less on the mind of Europeans than of Americans: A Dutchman will not start easily a business in Sicily, if the innovation or the costumers would be there and vice versa (see Ulijn & Gould, 2002). This might be a strong drive after the above discussed EU policy papers to develop entrepreneurship. A new European cultural identity is needed: that of Entrepreneurship, Innovation and Mobility (EIM) (See Fig. 3).

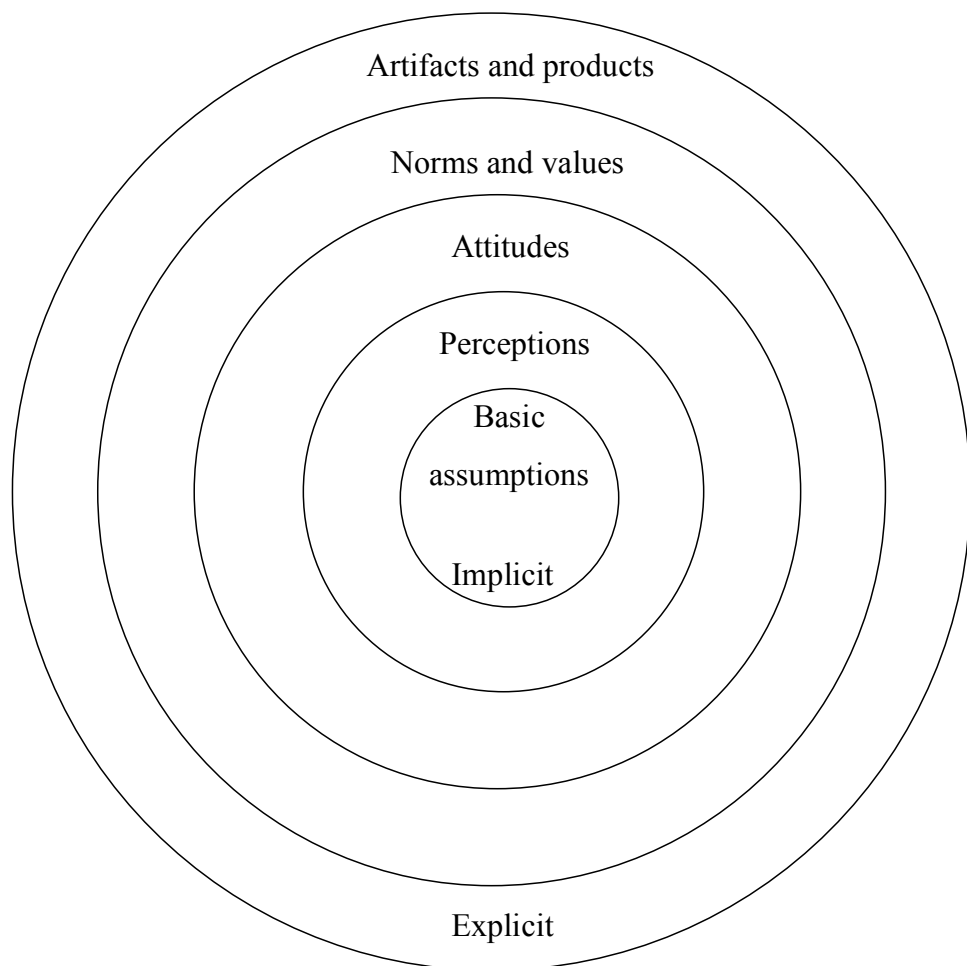


FIGURE 3
New cultural identity of Europe: Entrepreneurship, Innovation and Mobility (EIM)

Source: The onion model (based on Hofstede and Schein, both 1991)

The onion model adapted from Hofstede and Schein (both 1991) would allow in the technology entrepreneurship classroom to look at the (implicit) basic assumptions underlying entrepreneurship, how entrepreneurs are perceived, what their attitudes and norms and values are and that of their environment which has to accept or facilitate their venture in order to be successful. Innovation drive and mobility should be an integral part of the concept of entrepreneurial culture. Entrepreneurial spirit both in the US and Europe can reinforce each other by accepting each other's diversity and this can be translated in educational objectives across the Atlantic Ocean.

Slogan/question 5: Entrepreneurial spirit as a shared educational objective: What can one learn from each other? American taking risks, mobility and flexibility and European creativity and diversity in culture and content.

Both in the US and in Europe diversity seems to be an asset for entrepreneurial development, not a handicap. In the US, as a traditional country of immigrants it has led to a unifying culture that of mobility and flexibility, in Europe this

process of unification is much slower, if it would ever happen. A persistent diversity of national cultures here gives also elements of an entrepreneurial and innovative culture which may complement each other: *Let the French and Italians be creative in the design of products, for instance, let the Germans manufacture them and let the Dutch and the British market them.* In such a case much more mobility across national culture borders would be needed to merge the different talents of entrepreneurship. Creativity and Diversity in both culture and content should be part of European entrepreneurship education considering different special roles in MNCs, SMEs, and HTSUs and opposing technology to other business sectors as another source of culture (and content) variation.

How to bring those "wise" lessons and the ones proposed in the recent EU policy papers into educational practice?

Slogan/question 6: European Entrepreneurship policy: How to bring this to the classroom?

Some of the above comments should have to be made explicit in a set of objectives to pursue in the technology entrepreneurship classroom. Apart from the above formulated suggestions for integrated double engineering diplomas in technology management and entrepreneurship and the need for international and intra-European cooperation in technology entrepreneurship which should have an impact on the classroom, we summarize here:

1. Try to develop entrepreneurial spirit including how to deal with failure.
2. Focus on technology and innovation as an important source of new employment.
3. Work on a new culture or mindset and link it up with EU policy on those matters: there are funds to get you started. In this context it might be interesting to mention the usefulness of innovation culture papers as a tool of a mindset development, for instance Ulijn & Weggeman, as has been done by a Focus Group meeting of the PARTNER Thematic Network, in the spirit of Mintzberg & Gosling and Ferris. This network of regions from the Newly Associated Countries and some EU regions working on EU-funded Regional Innovation Strategy projects in Central Europe and the Mediterranean (Cyprus) is a spinout of the Innovating Regions in Europe Network (see www.partner-thematic-network.org).
4. As the above mentioned French OPPE initiative suggests, international and European teaching materials could be centralised in a clearinghouse, which measures also the effect of coaching and information supply by universities in actual start ups within CLUSTER, REEE, EFMD (European Foundation for Management Development) or other networks (www.entrepreneuriat.net).

So far diversity of culture was stressed, finally we present some conclusions with respect to the knowledge management aspect of our classroom as a source of content diversity. Starting a high tech firm is not the same as starting a specialized butcher or spare parts retail shop.

7. Conclusions from a knowledge management perspective in technology entrepreneurship.

The driving force behind all this seems to be that in particular in the case of the integration between engineering and entrepreneurship a reflection is needed on the interaction between codified, academic and tacit, experiential knowledge. Universities could play a strong role in the knowledge management process, cooperating among each other and with technology-driven firms of all sizes leading to successful high tech start ups in several scientific sectors. In fact we do not expect one 'hand', to be influential enough to make this happen, not even the far reaching one of the EU. Also the markets invisible hand will not suffice to make such changes, but many visible hands (see Rip & Groen, 2001, Groen, 2002) of purposeful actors in academic and practical contexts can construct a knowledge circulation process. Knowledge circulation between universities, professional education institutes on the one hand and entrepreneurs, engineers, firms on the other. Institutional support systems could be helpful as brokers in between.

Slogan 7: Technology entrepreneurship is knowledge intensive, it cannot succeed without a strong link with innovation: entrepreneurship education is a way of managing knowledge and skills between partners

To well understand the link between innovation, entrepreneurship, technology and knowledge management it would be critical to understand exactly what constitutes a High Technology venture. Medcof (1999) has identified three factors: research intensity, R&D expenditures and sales growth. Research intensity is probably the most employed indicator for measuring heavy dependence on science and technology innovation and therefore high technology ventures (Stearns & Allen, 2001). Some researchers have also found that HTSUs tend to employ relatively more scientists and engineers than do other firms (Jassawalla & Sashittal, 1998). All these views and results clearly show us that scientific knowledge is through research activity and intensity a core element of HTSUs.

But in this case, knowledge is probably also a competence. Entrepreneurs who attempt to launch their high-tech ideas may be the only competitors who possess the requisite knowledge (Fiet & Samuelsson, 2001). The knowledge related to a high technology venture may be a crucial asset because its informational basis is valuable and also because it is rare and inalienable (Jensen Meckling, 1992). HTSUs allow entrepreneurs to compete using specific procedural and declarative knowledge related to their innovations. Procedural knowledge is about how to do things and declarative knowledge is much more about general rules and laws (Anderson, 1990). As Fiet & Samuelsson (2001) suggest higher education may be the most common source of declarative knowledge. While declarative knowledge is much more depending on individual learning, procedural knowledge seems to be in relation to organizational learning through networking. As highlighted by Mustar (1997 & 1998) and Groen et al (2002), the driving force behind the creation of HTSUs

comes from the network: university laboratories, other enterprises, public agencies, technological programs, customers and finance companies. Scientists and engineers who create their own businesses have little in common with the heroic and solitary Schumpeterian entrepreneur. These entrepreneurs can do nothing alone and they need to succeed to be integrated into networks allowing interaction between a wide variety of actors. In this case, mainly through partnership, technology entrepreneurship is a collective phenomenon (Johannisson, 1998).

Under these conditions it seems that knowledge (tacit and explicit from the viewpoint of Nonaka and Takeuchi, 1997) is a strategic asset in technology entrepreneurship. Entrepreneurship education in technological universities and engineering schools should be much more oriented to knowledge management, issues and skills. One dimension could be to focus on the university role in producing and diffusing scientific and technological knowledge. Other could highlight the role of patents in technology entrepreneurship (Shane, 2001). Finally, the network dimension at the institutional and personal levels could be taught using a knowledge management perspective.

As a general conclusion, European technology entrepreneurship education is both a matter of intercultural and knowledge management with a diversity in culture both national and professional and content where engineering meets other disciplines. Although our above exploration of this issue is limited, we may conclude that educational objectives should be made explicit and specific in this sense.

There is no teaching/training dilemma, both should be used in a perfect harmony. Mintzberg' and Gosling's and Fennis' ideas about collaboration, interaction and partnership in the business classroom are in line with Black et al. Training rigor and participant involvement concept. Technology entrepreneurship classroom should go beyond the technicalities of the business plan and try to develop entrepreneurial spirit, make start up intentions concrete, learn to look for opportunities. An ideal education framework should include accordingly a balance between teaching and training, between academic (research) and vocational (practice). Scientific literature and lectures would support the first side, role plays, case studies and simulation the other. Both academic and practitioners are needed in close cooperation to make European entrepreneurship education effective. The effectiveness of the means to reach explicit educational objectives could be measured by counting successful HTSUs for instance. In the meantime exchange of best practices on entrepreneurship, innovation, culture and the communication and negotiation tools needed can be continued within CLUSTER, REEE and other frameworks.

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